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Ethics

OF THE

Engineering Profession

BY

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OF

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BOOKSTACKS

Ethics of the Engineering Profession.

The work of the professional man, be he doctor, lawyer, clergyman or engineer, always bears some direct relation to well-defined fundamental principles. These principles may result from the experience of humanity, they may come from *a priori* reasoning, or they may rest upon combinations of these two. But no profession can be regarded as stable until it has such a body of well-established principles as will guide a member of the profession in determining the actual value of his work, will teach him that his calling is honorable to himself and valuable to the community, and will determine what line of action may elevate the profession and instill into him the lesson that he must do nothing to bring reproach upon his chosen profession. In a word, they give him ideals to struggle for, and to struggle for an ideal is the only method of gaining true and lasting satisfaction. Pure professional success, as distinguished from mere money getting, depends upon acting in harmony with these principles.

A trade may be distinguished from a profession in that it does not recognize the importance of these basal principles. Not that the man at the bench, the machine, or the loom, does not need guiding principles in his work, but that they assume a distinctly subordinate place. The professional man must be a broader man, must have a wider grasp of relations, must have the ability to solve new complications, must be the leader and the thinker as well as the doer. The machinist may run his machine, but the mechanical engineer understands machinery. The electrician may close the circuit, but the electrical engineer understands polyphase machinery. The engine man may open the throttle, but the railway engineer understands railroading. The engineer, whatever his specialty may be, must base his practice upon the well-established laws of nature. If he belongs to the group of the successful rather than the unsuccessful engineers he must have plain, practical sense, a scientific education, tact, business ability and a strong personality.

The principles which underlie the legal profession, no matter what the lawyer may regard as professional ethics in a particular case, are statutes and the common law—that is, crystallized human experience. These laws form the principles upon which he aims to decide between right and wrong, between justice and injustice, and his work, except in certain criminal cases where the facts of guilt alone are to be proved, consists largely in properly fitting each new case under some one of the numerous general cases. The two parties to a suit merely urge the application of different principles, and the ultimate reason for legal wrangles is that the fundamental principles, according to which judgment is formed, are of purely human origin: consequently, they are in a state of change, of evolution. For this reason the determination of right and

time, in justifying his belief in the corpuscular theory of light, said that his "chief objection to the undulatory theory was that he could not think the Creator guilty of so clumsy a contrivance as the filling of space with ether in order to produce light." Less than thirty years ago I heard an instructor in one of the universities of this State advise his class that the writings of Darwin and Spencer were dangerous reading for young men. So thoroughly in sympathy have been the narrow intellects of all centuries in their inhospitable treatment of the truth! With all its wonders and triumphs, the crowning glory of the nineteenth century is that, in its closing years, men ceased to fear the truth. You have enjoyed a great privilege in receiving your education in the last decade of this century, and at this Institute, where truth has always been a welcome guest, although he now and then turns into the street some aged, familiar lounge about the porch of the temple of learning. It is only recently that the established belief regarding the composition of air was rudely ejected.

Now, what of the future? It gives to the young men who are about to start on their careers, notably to those of your profession, golden promises of success. At the opening of the last century Nature was man's master. Modern civilization has been a series of conquests over Nature. Year by year, as the new century unfolds, greater and greater triumphs will be achieved, and you will participate in the work of making the results of these victories available for the welfare and advancement of mankind. Greece and Rome, with all their superiority in literature and art, in philosophy and jurisprudence, gave to the world no great inventions. The Middle Ages covered Europe with cathedrals of unsurpassed beauty and grandeur, but made no new discoveries to lighten the toil or increase the comfort of the race. According to Wallace, only seven practical discoveries and inventions of the first magnitude were made from the dawn of history to the beginning of the nineteenth century: Alphabetical writing, Arabic numerals, printing, the barometer and thermometer, the mariner's compass, the telescope, and the steam engine. To the nineteenth century alone he assigns thirteen such discoveries and inventions: Railways, steamships, electric telegraphs, the telephone, Lucifer matches, gas illumination, electric lighting, photography, the phonograph, the Roentgen rays, spectrum analysis, anaesthetics, and antiseptic surgery.

Opinions will differ as to the correctness of these lists. To the first, I should add gunpowder, the screw, and what Gladstone called the greatest of man's inventions, because there was nothing in nature to suggest it—the wheel; and, in the second, I should include vaccination, the cotton gin, the typewriter, the sewing machine, and the self-binding reaper. But whatever we may think of the accuracy of the comparison made by Wallace, we recognize that the great majority of the inventions that now enter into the world's work were made during the last century. One hundred years ago the farmer was still the slave of the flail and the sickle, and his produce was laboriously dragged to market by horses at the rate of two miles an hour, or poled down the river on flat boats. New York City, in 1801, had no greater conveniences for the health and comfort of her citizens than London had in the days of Chaucer. Three-fourths of the population of the United States lived within fifty miles of the Atlantic, and of the five and one-half millions of people less than half a

million lived west of the Alleghenies. There were not more than two stationary steam engines in the country. A French engineer laid out the city of Washington, and an English physician of the West Indies drew the plans for the National Capitol. The steamboat of John Fitch and the locomotive of Oliver Evans were looked upon as the fanciful contrivances of impracticable fanatics, although the railway and the steamboat have made possible the conquest of the continent.

In our future competition for the world's trade great national works will be undertaken, and many of them will be completed in your time. We must have a waterway with a depth of twenty-one feet connecting Lake Erie with the Hudson, and a fourteen-foot channel from the Chicago River to the Gulf of Mexico. These waterways, in connection with the Nicaragua Canal soon to be built, will give cheap transportation for the raw materials and manufactured goods from the interior of our country to the markets of Europe and Asia. Millions of acres of arid lands in the West will soon be made fertile by irrigation plans carried out by national or state appropriations or by private enterprise. In all these great undertakings the men of your profession will be the leaders. Another important work of the twentieth century in which you will take part will be the improvement of the appliances already in use. The possibilities of steam, steel and electricity have not been exhausted. One of the most valuable lessons that men learned in the last century was that every human contrivance, however perfect it may seem, can be improved. In a recently published article Andrew Carnegie wrote: "It is scarcely within the bounds of belief that any cheaper process of making steel remains to be discovered." He had in mind the Siemens open-hearth furnace which was invented only a few years before he wrote, and which is even now supplanting the Bessemer process of 1864. Why should not some member of the class of 1901, of the Armour Institute, discover a method of making better and cheaper steel than can be made by the open-hearth process? Some one will surely make the discovery; the uses of steel will be multiplied, our present annual product of 11,000,000 tons will be greatly increased, and there will be an enlarged demand for skilled engineers at the mines and factories.

In 1825 Barlow, the English scientist, declared that an electro-magnetic telegraph was impossible, but in 1832 Henry had a line working successfully in his laboratory. Ten years later Morse had sent his immortal message from Washington to Baltimore and demonstrated the commercial value of his invention. Now the contract has been let for laying a sub-marine cable six thousand miles in length connecting Canada and Australia.

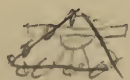
In 1852 Roebling built his beautiful suspension bridge over the Niagara River, with an 810-foot span. Twenty years later he and his son astonished the world by their construction of the Brooklyn bridge, with a 1,600-foot span. Plans have recently been completed for a bridge across the North River, with a 2,700-foot span. American engineers have built bridges in Australia, Burmah, and South America. The construction of the bridge at Hawkesbury, Australia, gave a splendid example of the resourcefulness of the modern engineer. Soft, deep mud made it impossible to build the span on piles adjacent to the piers. So it was put together

on a staging erected on a pontoon. When the span was finished the pontoon was towed to the piers at high tide, and by the ebbing of the tide the span was gradually lowered into position. When the modern engineer finds the ordinary appliances inadequate for his purpose he employs the moon to work for him, lift his span and put it on its piers.

Future improvements in railway construction will demand the highest skill of the trained engineer. Already there are 190,000 miles of railway in the United States, crossing 63,000 bridges, and constructed and equipped at a cost of \$10,000,000,000 during the last two generations. If we could have a panoramic view of the trains that have left Baltimore during the last seventy years it would give us a good idea of the changes that have taken place in railway construction between the days of the coach with mast and sail and the Titanic "consolidation" locomotive.

The results that have been accomplished in cheapening the cost of transportation in the last thirty years indicate what great changes we may look for in the next generation, as the outcome of work in which some of you will be engaged. The old wooden cars, weighing sixteen tons and carrying a paying load of fifteen tons, have been superseded by the modern pressed-steel cars, of no greater weight, but carrying a load of fifty tons each. The old thirty-ton locomotive, struggling with thirty cars and a paying load of 450 tons, has retired in favor of the Mogul and Consolidation, which can haul fifty steel cars with a paying load of 2,500 tons. In 1867 the total freight carried in the United States was 75,000,000 tons, for which the charges were \$400,000,000, or \$5.33 per ton. In 1899, 976,000,000 tons were carried for \$922,000,000, or 95 cents per ton. This great and rapid reduction in freight tolls has been the most potent factor in enabling us to send abroad this year nearly \$1,500,000,000 in the products of our farms and factories. Future improvements that will reduce the cost of construction, maintenance, and operation will bring about a still further cheapening of the cost of transportation. A fortune awaits the man who will invent an angle-bar that will make the joint as durable as the rail. Fame and fortune both wait on the genius who will discover a cheap method of permanently preventing the oxidation of iron.

In my opinion the most interesting, and perhaps the most important, work that will engage the talents of the twentieth century engineer, architect, and scientist, will be the making over of the nineteenth century city. During the last fifty years the cities of the world have increased in population with a rapidity never before paralleled. In most instances this growth has been so sudden and tremendous that we have been able only partially to adapt modern appliances to the rapidly changing conditions, and often after a very clumsy fashion. And yet, a hundred years ago, there was nothing to suggest the possibility of the development within a century of our great interior cities. If a member of the class of 1801, of Harvard College, had given as his commencement address an accurate prophesy of the majestic city that, before the century's close, would rise, "like an exhalation" from the marshes at the mouth of the shallow creek at the headwaters of Lake Michigan, he would have been regarded as the greatest imaginative writer of his times. But if I should attempt to describe tonight what I believe will be the Chicago of the next century I should have to use language that would seem equally extravagant.



Many of the improvements that are to take place in our city you will witness when you return to celebrate your fiftieth anniversary, and some of you will take part in planning and carrying them out. Some of the changes that will come we can now predict, but many more will be the outgrowth of further inventions and discoveries. In the well-built and well-governed city of the twenty-first century the water supply will be purified at its source, or in reservoirs. The sewage will be used to fertilize a municipal farm upon which all who wish can find honorable employment. All wires and pipes will be laid in tunnels under the streets, and through these tunnels most of the passenger and freight traffic will be carried. There will be no rails on the surface of the streets, and all the traffic in the streets will be moved by electricity. Cheap and rapid transportation will carry the city workers to their homes in houses with yards on the outskirts of the city. There will be no over-crowded tenement houses, no congested areas, no plague spots, in the new city. But, in their places, there will be public baths, lavatories, and playgrounds, and municipal lodging-houses, wash-houses, and kitchens. Light, heat, and power will be generated in the form of electricity at adjacent mines and brought to the city by underground cables. The twenty-first century city will be a clean, light, healthy city, intelligently adapted to the comfort and security of all its inhabitants. Those of us who are living at the opening of the twentieth century will be glad enough to see the transformation begin.

I have barely touched upon a few features of the work of improving present appliances which will engage the attention of your profession in the immediate future. But surely these illustrations are sufficient to show the great opportunities that are in store for you, and to arouse that strong feeling of enthusiasm without which great achievements are impossible. Sir Humphrey Davy, scientist, poet, and philanthropist, who began life, as he once wrote, with "a look toward future greatness," has disclosed to us the secret of its attainment. "Almost all great deeds," he said, "arise from a plenitude of hope or desire. No man ever had genius who did not aim to execute more than he was able." With the inspiration that you have received during your years of study you will aim to accomplish something more than the carrying out of the plans of others or the mere improvement of their discoveries. *You must be inventors as well as engineers.* The engineer and the architect must often carry out the wishes of their clients against their own judgment. Therefore, give all the time and energy that you can command to original work and the discovery of new uses to which the forces of nature can be applied. Electricity alone furnishes an inexhaustible field for the genius of the inventor. What an infinity of uses awaits the invention of a light, cheap, and powerful storage battery! With such a battery the problem of aerial navigation will be solved and the airship will become a practical utility for many purposes, including life-saving from shipwrecks.

It has been estimated that an invention which shall secure the complete combustion of all the carbon in coal will cause a saving of 100,000,000 tons in the world's present annual consumption of coal. Who will earn the blessings of his fellow-men by inventing a cheap and healthy method ventilating and cooling in hot weather and tropical climates the

into the dwellings, hospitals, and factories? The inventor is the benefactor of his race. Davy's safety lamp has saved thousands of lives. His inventions for usefulness are greater than his. With our enlarged knowledge of the laws of nature, the useful inventions of the next century ought to exceed in number and importance all those of the last century. A repetition of the thrilling experiences of Davy, Morse, Roentgen, and the other renowned inventors, who seemed to touch the limits of human ingenuity, may seem to timid minds impossible;

"Yet all experience is an arch wherethro'

Gleams that untravel'd world whose margin fades
Forever and forever when I move."

Twenty years ago Erichsen, one of the ablest surgeons of London, publicly announced his belief that "surgery had reached its limits." But since this sentence was uttered surgery has achieved some of its most wonderful and beneficent triumphs. One thing, however, the inventor must bear in mind: Few great inventions in the future will be the result of accident or aimless investigation. They will, on the contrary, be the outgrowth of patient, laborious, intelligently directed research. The devices that will secure the perfect combustion of coal, prevent the oxidation of iron, give practical utility to the storage battery, wireless telegraphy, and sub-marine telephony must be wrought out by the painstaking process of eliminating obstacles and adding improvements, one by one. Other inventions of far-reaching importance will be made by brilliant investigators, who will start with a clear conception of what they wish to accomplish and work out the result with infinite attention to details.

Some men have a genius for scientific investigation, as others have an aptitude for languages, music, or mathematics. But most of these geniuses lack time and opportunity for research. Oliver Lodge, in a recently published article on the "Scope and Tendencies of Physics," says: "It was the uniquely endowed laboratory of the Royal Institution, London, which enabled Faraday to realize his genius. Men able to experiment are not lacking; laboratories—research laboratories—and the leisure to employ them, are the urgent need of all countries at the present time." I would like to suggest to some man of wealth and public spirit, who wishes to emulate the wise philanthropy of the founder of Armour Institute, and mark the opening of the twentieth century by an act of generosity in harmony with the enlightened spirit of the age, that he establish and endow in connection with this school *a chemical and physical laboratory designed exclusively for original research*. Let the endowment be generous, and let the income be devoted, not to the salaries of teachers or scholarships for students, but to provide ample incomes and all possible facilities for specially-trained scientists, who shall give their time and energy to inventions and discoveries of practical utility. It is impossible to estimate the beneficial results that would flow from such investigations. The man who will give his name to such a munificent endowment will be remembered for his broad-minded liberality centuries after his ninety-nine-year leases have run out and all his other investments have ceased to bear interest.

I have now spoken briefly of the encouraging openings which the new century discloses to the enterprise of the engineer and the ingenuity of

the inventor. But the work of both is strictly practical, utilitarian, commercial. Whatever the engineer can construct, or the inventor devise, has a money value, or it is valueless. Now, anything that can be valued in money has not the highest value. The value of truth can not be expressed in money, or in any other terms; for truth is the sum of all values. The bankers of Florence would give nothing for Galileo's discovery; London brokers would not accept from Newton the law of gravitation as collateral; and Lord Rayleigh could get no bid from Wall Street on argon. The noblest activity of the human intellect is the pursuit of truth for its own sake. You, therefore, who have learned the value of truth, must be not only engineers and inventors, but *scientists*; for the scientist is the simple seeker after pure truth. In this search you will be free from the sordid demands of clients and employers, free from the oppressive atmosphere of commercialism, free from the superstitions and traditions of the past, free at last to approach, without fearing the truth, the profoundest mysteries of the universe. The wise and great of all past ages will guide you to the end of their journey, and where they leave you alone with Nature you will begin your journey and explorations in the illimitable realm of undiscovered truth. Who can describe the exultation of the traveler in this vast, mysterious realm? Who, that has not felt a similar joy, can understand the thrill of ecstasy that overcomes the "watcher of the skies, when a new planet swims into his ken?"

Of one thing I am convinced—that the earnest seeker after truth, as his knowledge of the material world increases, will approach the unrevealed secrets of the universe in a spirit of devout reverence. We may admit the demonstrations of Copernicus and Galileo, of Kepler and Newton, of Buffon and Darwin, and find temporary mental repose in the nebular hypothesis, but what do we know of the origin of matter? In the presence of the tremendous truths of the conservation of energy and the indestructibility of matter we can only exclaim, as Hutton did a century ago: "In the economy of the world I can find no traces of a beginning and no prospect of an end." We may penetrate the remotest confines of the domain of knowledge, and ascend to the loftiest heights of speculation; we may tell the composition and temperature of the stars, and measure the orbits of unseen planets; but who has discovered the inception of organic life? "There is a path which no fowl knoweth and which the vulture's eye hath not seen." We may hold, as it were, the universe in the palm of our hand, as Goethe held the skull of his friend, Schiller, but in the universal sphere we can find no solution of the awful mystery of human life, any more than the philosopher could discover within the narrow walls of bone the secret of the power of the dead poet. The monument to Newton in Westminster Abbey tells us that the greatest of scientists "asserted in his philosophy the majesty of God and exhibited in his conduct the simplicity of the Gospel." The man of science of the twentieth century, even with his increased knowledge of the material world and his enlarged control over the forces of nature, should approach the inner mysteries of the universe with the same spirit of humility and reverence toward the truth which added lustre to the fame of the great philosopher of the seventeenth century.

Now, with all this bright prospect before you of useful accomplish-

ment in all the departments of thought and activity in which you are interested, what, you are asking yourselves, are the conditions essential to success? Men differ in their ambitions and aspirations, and in their opinions as to what constitutes success. Of one thing you may be sure—that, twenty-five years from now, your idea of success will be different from what it is today; and fifty years hence you will hold still another opinion of the ultimate object of life. Individual success, it seems to me, consists in a certain completeness or perfection of a design for which Nature has furnished the framework. The oak and the violet are each a success, but you can not make ship-timber out of the one or extract perfume from the other. A blind man would be a failure as an astronomer, though he might become a brilliant musician. That man, therefore, is fortunate who discovers early in life what Nature intended him for, and sets about filling in the framework. With some the work is done quickly, while others devote weary, and what seem profitless, years to the task. Morse was past fifty before he could convince Congress of the value of his invention. At forty-seven, Audubon was painting all day and selling his pictures after dusk in the streets of London. No success is worth having that is not worth earning; and it has a peculiar sweetness if it has been earned by hard struggle and patient waiting. It does not appear that men of science are apt to make wealth the gauge of success. Sir Humphrey Davy refused to make a fortune by taking out a patent monopolizing the sale of his safety lamp; Linnaeus, the devoted botanist, after he had overcome his early poverty, wrote to a friend, half humorously, half pathetically: "Once I had plants and no money; now, what is money good for without plants?" Whether you are destined to attain fame and immortality, or to acquire wealth and power; or, better still, to make some wonderful discovery; or, best of all, to confer some great benefaction on the race, the opportunities for earning success in all these forms were never so great as they are today. The spirit, therefore, which should dominate and direct the life of the young man who enters on his career at the beginning of this century, is the spirit of expectancy. He should begin life, not merely with hope, which is the universal animal instinct of youth, but with confident expectation that he will witness in the future triumphs as great as any that have been achieved in the past; that he will take part in these triumphs, and that his conscientious labors will be surely crowned with success.

You will each of you do well to take with you on your journey two servants, who are not always companionable, but whom you must train to serve you in harmony. Enthusiasm and Patience have always been the faithful attendants of the men who have succeeded.

If you have not already adopted the habit, let me recommend to you a practice that you will find of inestimable value. Select some one subject and make yourself master of all that can be known about it. It is immaterial what the subject is, only let it be as limited as possible, and, if it is one in which you are interested, so much the better. The essential idea is *to know everything about one thing*. I have heard a story of a German scientist who in his youth determined to acquire a complete knowledge of the universe. He soon found it necessary to confine his studies to the solar system. Then he determined to limit his investigations to the earth

and its occupants. When he began to realize the shortness of life compared with the infinite bounds of knowledge, he rapidly restricted his researches, first to organic life, then to animals, then to the group of articulates, then to lepidopterous insects, then to the family of moths, then to one genus, then to a single species; and, finally, devoted the last fifty years of a long life to the study of the antennae of the *Atticus Cecropia*. "And what benefit," exclaimed the narrator, "did this philosopher derive from the accumulation of such a mass of accurate information?" "Why, no one was ever able to impose upon him the antennae of any other moth for those of the *Atticus Cecropia*!" It is not, however, the information that you acquire by this complete mastery of one subject which will help you, but the power of discrimination which the practice gives. It is the best antidote for undue self-esteem; for, when you know one thing thoroughly you become thoroughly aware how little you know about all other things. This habit of mind, which you can develop by the mastery of one subject, will enable you to estimate correctly the value of your own judgments on other subjects concerning which your opinion must be largely a matter of inference or deduction. It will also furnish you a valuable test by which to gauge the thoroughness and accuracy of the work of others.

It is surprising what a gulf there is between a superficial and a complete knowledge of any subject. When you have bridged this gulf once you will forever afterwards be dissatisfied with slovenly work and superficial knowledge in yourself and others. "Finish one picture, sir, and you are a painter," said West to his pupil Morse, who was almost in despair at his teacher's repeated corrections. Darwin devoted eight years to the study of barnacles and the preparation of his treatise on cerripeds. Huxley pronounced this work of Darwin "a piece of critical self-discipline, the effect of which manifested itself in everything he wrote afterward." We can all practice this same sort of self-discipline. If you have a taste for pictorial art, master the subject of line engraving; if your fondness is for literature, make one poem your constant companion. If, on the other hand, your inclinations lead you to physical and chemical research, know everything about one substance. If natural history claims your affections, make an intimate friend of one animal or flower. The acquaintance of a lifetime will not exhaust their interest and attractiveness. Let us suppose, for example, that you have selected as your special friend the common tawney-red butterfly of our summer fields, the *Danaïas Archippus*. What entomologist can tell you the comparative weights of the egg, the larva, the chrysalis, and the fly? How long is the life of the insect? What is its habitat, its daily and nocturnal habits? What senses has it? Has it senses which the larva has not? If larvae from the same set of eggs are fed on different plants will there be any corresponding differences in the butterflies? In what stage of existence does this frail creature resist the frosts of winter, as a butterfly, chrysalis, larva, or egg? Can the size of the butterfly or the color of its wings be changed by changes in the food of the larva or by any treatment of the chrysalis? When you shall have answered all these questions you will find no one who will give you a cent for the information, but the habit of accurate observation which you will have acquired may be worth to you fame and fortune. Rayleigh's discovery of argon has been ascribed to his fastidiousness respecting the weight of nitrogen.

The twentieth century engineer will be a busy man, as you will soon realize. You will become engrossed in the practical work of your profession, and will find little time even for scientific investigations. Do not, however, on this account neglect entirely the claims of literature and art. As Goethe, the man of letters, found strength and refreshment in scientific research, so the man of science may drink invigorating draughts from the cool fountains of literature. Newton was wont to refresh himself with history and chronology. Morse found recreation in Homer, Spencer, and Dante. Twenty minutes a day devoted to reading will take you in a year through the greatest classic poems of Hebrew, Grecian, Roman, and English literature; and, with the returning years, you will experience the keen delights of renewing old friendships, for each re-reading will disclose to you new truths and beauties. If you begin the day by communion with these great spirits you will take with you to its end thoughts that will often help to lighten its drudgery and illuminate its gloom.

So far I have spoken only of the opportunities for individual development and success that awaits you in the new century. Let me say in closing a few words respecting the duties and responsibilities that rest upon you and all other young men of the country in your capacity as citizens. Here *your opportunities are the measure of your obligations*. Citizenship is something in which everyone can succeed. Every member of the Republic, therefore, should be first of all a good citizen. The man, however, who has received education, wealth, or other especial advantages, owes a two-fold duty to the State—the duty of simple citizenship and the duty of making a full return for the benefits which he has received. Whatever else he may accomplish, the man who falls short of the fulfillment of these obligations fails to make his life complete. One of the earliest laws passed by the Pilgrims of Plymouth was a statute imposing a fine upon those who refused to accept public office. There seems to be little call for the enactment of such a statute at the present time, but we do need some moral force that shall arouse men to a quickened sense of the obligations of citizenship.

Science teaches that the history of organic life always has been, and always will be, not only that the stronger live and the weaker perish, but that the stronger survive through the death of the weaker. To man, alone, has been granted the power to stay in a measure, for the benefit of his fellow-men, the workings of this relentless law. The protection of the weak by the strong differentiates man from the brute; and the extent and character of the protection given to the weak by the strong, in any community, mark the degree of civilization which it has attained. This Republic was founded for the purpose of securing to its citizens the rights of life, liberty, and the pursuit of happiness. Are the hopes of the founders being fulfilled? A system of government under which, although all men have the right to pursue happiness, only some attain it, has not reached an ideal development. With many thousands in this country the pursuit of happiness is still nothing but a pursuit. It is true, there has been great progress during the last century in the treatment of the weak, helpless, and unfortunate, especially in the care of the diseased, the insane, and the feeble-minded, and in the reformation of the criminal and vicious. But much still remains to be done for the amelioration of those classes.

The greatest dangers that now threaten the safety of the Republic lie in the rapid concentration of population in the large cities, the concentration of immense wealth in the hands of a few individuals and corporations and its corrupt use and the concentration of governmental functions in the executive branches of the Nation and States. As I have already intimated, the men of your profession will play a leading part in the physical regeneration of our cities; but their moral and political regeneration can only be accomplished by the combined efforts of all the citizens. We greatly need in the administration of our American cities the services of trained specialists in engineering, finance, and hygiene.

In a rich Democracy, great inequalities in the distribution of wealth are a sign of weakness in the form of government or disorder in the social system. A nation in which the total wealth is constantly increasing, but where the poor are becoming poorer and increasing in numbers, is drifting toward revolution. War and the preparations for war increase the misery of a nation's poor, not only through economic waste, but because the familiar contemplation of the horrors of distant conflicts dulls the national perception of distress at home. Tennyson was one of the wisest and most sympathetic students of the great social problems of his age. As he saw Europe converted into a military camp, and witnessed the abject condition of many of his countrymen, he uttered the universal prayer of this generation:

* * * "Ah! when shall all men's good
Be each man's rule, and universal Peace
Lie like a shaft of light across the land
And like a lane of beams athwart the sea
Thro' all the circle of the golden year?"

Peace is essential to the highest moral and economic development of the nation. The world has heard much of the glories of war on the one hand, its deeds of valor, endurance, and heroism—and on the other, of the horrors of its conflicts, but the world has given too little heed to its fearful economic waste. Some conception of the terrible import of the cost of war may be had if we consider that, of the total expenditures of this Nation since its foundation, amounting to sixteen billions of dollars, two-thirds, or over ten billions, have been made on account of the Civil War of 1861. This sum would have provided for the manumission of all the slaves at an average of \$1,000 each, and left over six thousand millions of dollars to be used in the economic development of the country.

If we can avert war in the coming century, our country will realize the hopes of the founders of the Republic. In our population there will always be the strong and the weak, but there should be no submerged tenth. There will always be a lowest stratum in the composition of all human societies, but the aim of our civilization should be constantly to diminish the size and raise the level of this lowest stratum. We have in this country unbounded natural resources and accumulated capital; and, with an enlightened national sentiment, intelligently expressed through faithfully executed laws, there will be no starvation, no pauperism, no grinding poverty in our society.

The success of any system of popular government depends upon the tireless, determined insistence of the people that the laws and those who make, execute, and interpret them shall at all times faithfully reflect and carry out the wishes of the people. In so far as they fail to do this, the government ceases to be a government by the people. The historian of the United States, writing a century hence, will note that toward the end of the nineteenth century the people began to manifest a spirit of indifference to the character of the laws and the manner of their execution; that, owing to this indifference, the national legislature showed a disposition to deal with matters that the founders of the Republic thought it would be wiser to leave to the local legislatures; and that the representatives of the people in the various legislative bodies showed an inclination perfunctorily to pass laws respecting the important matters of taxation and appropriations, solely on the recommendations of the executive departments. It rests with us of this generation to determine how the historian shall conclude his narrative. Upon you especially, the young citizens of the Republic, will fall the responsibility of resolving that this spirit of indifference shall not prevail. Your opportunities for success in your chosen calling are great; your opportunities for rendering useful service to the Republic are still greater. Let me repeat, in closing: Your opportunities are the measure of your responsibilities. Be true, therefore, to the ideals of your profession and loyal to your duty as citizens; and the honor which you will reflect upon your Institute, will be new proof of its power for good, and of the enlightened wisdom of its founder.